Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(NEW) – EXAMINATION – SUMMER 2019

Subject Code:2140603 Date:20/05/2019

Subject Name: Structural Analysis-I

Time:02:30 PM TO 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define:(1) Principle of Superposition **03**
(2) Maxwell's Reciprocal Theorems

(b) Find static and kinematic indeterminacy for the structures shown in below Fig.1 and Fig.2. **04**

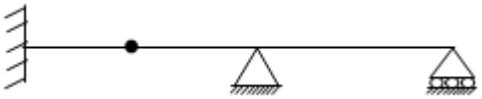


Fig.1

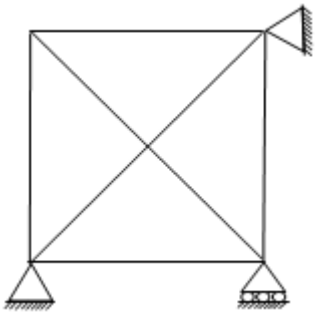
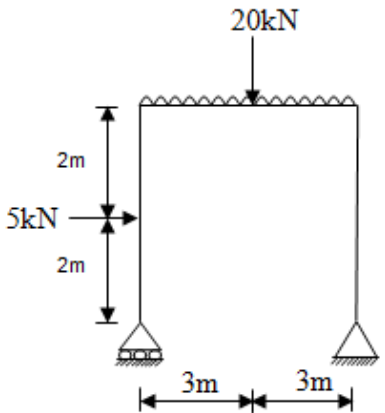


Fig.2

(c) Draw shear force diagram, bending moment diagram and axial force diagram for the plane frame shown in Fig.3.Consider UDL intensity as 10kN/m. **07**



Q.2 **(a)** Define and explain : Kernel of rectangular section. **03**

(b) What is conjugate beam? Differentiate between real beam and conjugate beam. Justify the support condition in conjugate beam **04**

(c) Find slope at point A and D & deflection at point B for the beam shown in Fig.4 by Macaulay's method. E=200 GPa and I=14400 x 10^4 mm^4. **07**

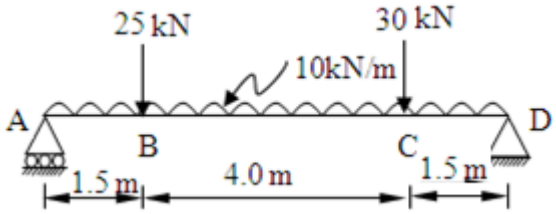


Fig.4

OR

(c) Find slope & deflection at free end of the beam shown in Fig.5 by Moment area method. E = 200 Gpa and I=16500 x $10^4 mm^4$. **07**

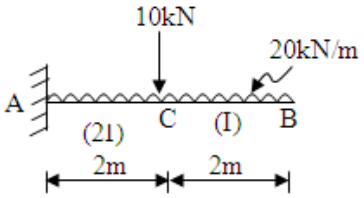


Fig.5

Q.3 **(a)** Explain any two stability conditions for retaining wall. **03**

(b) Calculate the critical load for a strut which is made of a bar circular in section and 4 m long and which is pin jointed ant both ends. The same bar when freely supported gives a mid span deflection of 10mm under a load of 80N at the centre. **04**

(c) A masonry dam 5 m high, 3 m wide at base and 1 m wide at top, retains water on vertical face for full height. Considering density of masonry as 17 kN/m^3 and density of water as 10 kN/m^3, find out maximum and minimum pressure intensities at the base. **07**

OR

Q.3 **(a)** Explain with neat sketch: Effective length of column with different end conditions. **03**

(b) A hollow circular pipe having internal diameter 300 mm and 40 mm thickness is used as a column. Find critical load using Rankine's formula. σ_c = 320 MPa, α = 1/4800, Slenderness ratio is 90. What will be the length of column if it is fixed at one end and free at other end. **04**

(c) A rectangular column section ABCD (**Fig.6**) having side AB=CD=500 mm and BC=AD=300 mm carries a compressive load of 200 kN at corner B. **07**

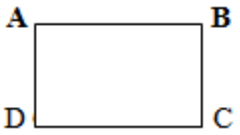


Fig.6

Find stress at each corner A,B,C,D and draw stress-distribution diagram for each side.

Q.4 **(a)** Explain with neat sketch : Stresses in thin cylindrical shell and thin spherical shell **03**

(b) Define and explain : Anchor cables **04**

(c) A three hinged parabolic arch has span 20 m and central rise 3 m. It carries a point load of 15 kN at 7 m from the left hinge. Calculate normal thrust, shear force and bending moment at section 8 m from right end hinge. Also calculate maximum positive and negative bending moments and their positions. **07**

OR

Q.4 **(a)** Explain advantages of three hinged arch over beam. **03**

(b) A thin sphere of 1.2 meter diameter is filled with fluid which exerts internal pressure of 3 MPa, calculate the thickness required for the sphere if the change in volume is not to exceed 1.5 % of the original volume. **04**

(c) A cylindrical shell 3 m long and 1 m internal diameter is subjected to an internal pressure of 1 Mpa. If the thickness of the shell is 10 mm, find the circumferential and longitudinal stress. Find also the maximum shear stress and change in dimensions of the shell. Poisson's ratio is 0.3 and Modulus of elasticity is 200 GPa. **07**

Q.5 **(a)** Define : Resilience, Proof resilience, Modulus of resilience **03**

(b) A 1600 mm long wire of 50 mm^2 c/s area is hanged vertically. It receives a sliding collar of 150 N weight and stopper at bottom end. The collar is allowed to fall on stopper through 200 mm height. Determine the instantaneous stress induced in the wire and corresponding elongation. Also determine the strain energy stored in the wire. Take E as 200 Gpa. **04**

(c) Find the fixed end moments for the beam loaded as shown in Fig.7. Draw shear force diagram and bending moment diagram of the beam. **07**

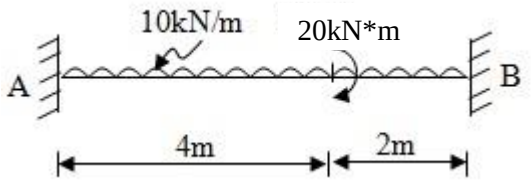


Fig 7

OR

Q.5 **(a)** Explain strain energy due to flexure in beam. **03**

(b) Derive the relation between slope, deflection and radius of curvature of the beam. **04**

(c) Using the method of consistent deformation method, compute all reactions and draw shear and moment diagrams. Take E=200GPa & I= $80X10^6mm^4$. Refer Fig.8. **07**

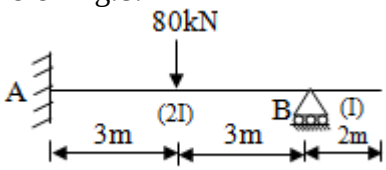


Fig.8